

REMARKS

This Amendment is fully responsive to the non-final Office Action dated January 26, 2007, issued in connection with the above-identified application. A one-month extension of time accompanies this Amendment. Presently, claims 1-20 are all the claims pending in the application. With this Amendment, the specification, abstract, and claims 1, 3-4, 7-8, 11-12 and 14-17 have been amended. Additionally, claims 2 and 13 have been canceled. No new matter has been added by this Amendment; thus, reconsideration is respectfully requested.

At the outset, to facilitate the Examiner's reconsideration of the application, the Applicants have provided a substitute specification and a replacement abstract. The changes to the specification and abstract include minor editorial and clarifying changes. In addition to the substitute specification and replacement abstract, a "marked-up" copy of the original specification and abstract are also enclosed.

In the Office Action, claims 1-4, 8, 10, 12-15 and 20 stand rejected under 35 U.S.C. §102(b) as being anticipated by Aarts et al. (U.S. Patent No. 6,111,960, hereafter "Aarts-A"). Claim 11 stands rejected under 35 U.S.C. §102(b) as being anticipated by Klayman (U.S. Patent No. 6,285,767, hereafter "Klayman"). Additionally, claims 5-7 and 16-18 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Aarts-A, and claims 9 and 19 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Aarts-A in view of Aarts et al. (U.S. Patent No. 6,961,435, hereafter "Aart-B").

With regard to independent claims 1, 11 and 12, the Applicants have amended the claims to point out that the present invention decomposes the low frequency components of each of a fundamental tone and harmonic-tones of the fundamental tone, initially in the same band, into different frequency bands. (see Applicants' Application, ¶68-¶74).

More specifically, claim 1 as amended recites "[a]n audio-signal-processing apparatus comprising: a band-decomposition unit, having a decomposing characteristic, operable to decompose a low frequency component of input-audio-signals into a plurality of frequency components that have different frequency bands based on the decomposition characteristic;... wherein said band-decomposition unit is operable to decompose the low frequency component of each of a fundamental tone and harmonic-tones of the fundamental tone initially in a same band such that each belongs to a

different frequency band.” Features similar to these are also recited in independent claims 11 and 12. Additionally, these features are not disclosed, taught or suggested in the cited references.

Aarts-A discloses a system for processing an audio signal, in which a frequency band is selected. More specifically, the system includes adjacent bandpass filters (as illustrated in figure 9), such that each bandpass filter is configured to select a 10 hertz band (e.g., 0-10 hertz, 10-20 hertz, 20-30 hertz, etc.). As described in the reference, the adjacent bandpass filters are implemented to avoid intermodulation distortion, which occurs during the generation of harmonic frequencies (see Aarts-A, Col. 9, lines 3-23). However, Aarts-A is silent with regard to decomposing low frequency components of each fundamental tone and harmonic-tones of the fundamental tone, initially in the same band, such that each belongs to a different frequency band. Thus, the system in Aarts-A is not intended to suppress fundamental tones and harmonic-tones that belong to the same band, or to suppress fundamental tones and harmonic-tones initially in the same band.

Therefore, the audio-signal processing system of the present invention is distinguishable from Aarts-A in that the band-decomposition unit is intended to suppress the fundamental tones and harmonic-tones belonging to the same band; thereby suppressing sound quality degradation in complex tones.

Moreover, Klayman and Aarts-B fail to overcome the deficiencies noted above in Aarts-A. Klayman discloses an audio enhancement apparatus that spectrally shapes harmonics for low frequency components of an audio signal. As described, this shaping technique is performed so that when the audio signals are reproduced by a speaker, the speaker appears to have more acoustic bandwidth. However, although Klayman includes the use of staggered bandpass filters, each bandpass filter is tuned to a single frequency (e.g., 100 hertz, 150 hertz, 200 hertz, etc.) (see Klayman, Col. 14, lines 40-50). Additionally, Aarts-B merely discloses a bandwidth extension device that implements the use of two bandpass filters BPF11, BPF12 and two harmonic generators HG1, HG2 to produce two separate streams of harmonics of selected frequency bands. (See Aarts-B, Col. 2 lines 6-24). Similar to Aarts-A, Aarts-B and Klayman are silent with regard to decomposing low frequency components of each fundamental tone and harmonic-tones of the fundamental tone, initially in the same band, such that each belongs to a different frequency band.

Accordingly, Aarts-A, Klayman and Aarts-B (individually or in combination) fail to disclose,

teach or suggest all the features recited in independent claims 1, 11 and 12 (as amended). In particular, the cited references fail to disclose, teach or suggest the decomposition of a low frequency component of each of a fundamental tone and harmonic-tones of the fundamental tone, initially in the same band, into different frequency bands. Accordingly, independent claims 1, 11 and 12 are now patentably distinguished over the cited references. Additionally, dependent claims 2-10 and 13-20 are patentably distinguish over the cited references based at least on their dependency on independent claims 1 and 12, respectively.


In addition to the reasons noted above, dependent claims 3, 5-6 and 14, 16 and 18 are patentably distinguishable over the cited prior art on their own merit. With regard to dependent claims 3 and 14, the claims have been amended to recite that “each bandwidth of the plurality of frequency components is defined based on a lowest fundamental frequency of a particular musical instrument.” (see Applicants’ Application, ¶¶84-¶85). Conversely, Aarts-A discloses the use of bandpass filters to avoid intermodulation, Klayman discloses bandpass filters tuned to specific frequencies, and Aarts-B is silent with regard to setting bandpass filters to a specific bandwidth. Thus, dependent claims 3 and 14 are now patentably distinguished over the cited references.

With regard to dependent claims 5-6, 16 and 18, the claims are directed to a bandwidth of each of the different frequency bands being from “15 hertz to 50 hertz,” or from “15 hertz to 30 hertz.” On the other hand, Aarts-A merely discloses the use of bandpass filters for generating 10 hertz bandwidths, Klayman discloses bandwidths tuned to specific frequency, and Aarts-B is silent with regard to generating a specific bandwidth. Thus, claims 5-6 and 16 and 18 are patentably distinguished over the cited references.

In light of the above, The Applicants respectfully submit that all the pending claims are patentable over the prior art of record. The Applicants respectfully request that the Examiner withdraw the rejections presented in the Office Action dated February 9, 2007, and pass this application to issue. The Examiner is invited to contact the undersigned attorney by telephone to resolve any remaining issues.

Respectfully submitted,

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